

REMARKS

Figures 1, 4, 5, 8 and 11 have been amended to correct minor clerical errors.

The specification has been amended to correct minor clerical errors and to employ more idiomatic English. Claim 2 has been canceled, without prejudice, and its subject matter has been incorporated into claim 1. The Abstract has been canceled and replaced with an Abstract believed to contain sufficient description of the invention. No new matter has been entered by any of the foregoing amendments.

Turning first to the drawing objections, in Figure 4, the write-back has been renumbered from 522 to 521 to correspond to the numbering in the specification. Elements B20 and B40 in Figure 8 have been amended so as to read 820 and 840, respectively. And, references to elements 451 and 452 in the specification have been removed.

The Abstract has been canceled and has been replaced with an Abstract that is believed to contain sufficient description of the invention, thereby traversing the objection thereto.

Turning now to the objections to claims 1 and 2 set forth in cipher 7 of the Official Action, Applicant thanks the Examiner for pointing out these clerical errors, which have now been corrected.

Turning now to the rejections of claims 1 and 2 as indefinite, Applicant has canceled claim 2 and incorporated its subject matter into claim 1. The terms "normally" and "possible" have been removed from this claim. Further, antecedent basis is now provided for the limitation "the function" as set forth in cipher 9 of the Official Action. Regarding the rejection of claims 1 and 2 as indefinite, as set forth in cipher 10 of the Official Action, the sentence "SSA form is normally only usable on function local variables" has been deleted, and claim 1 is

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now believed to be in proper form. It is thus believed that the indefiniteness rejections have been traversed.

Turning now to the art rejections, and considering the rejection of claims 1 and 2 as anticipated by Chow et al. (U.S. Patent No. 5,768,596), and as anticipated by Radigan (U.S. Patent No. 5,999,735), claim 1, as amended, requires the steps of “determining the operations of said function that have the potential to implicitly read or write complex variables that are in SSA form, and for said operations, generating a list of said complex variables and said potential reads or writes”; “adding, based on said generated list, write-back copy operations at appropriate locations to write said complex variables that are in SSA form, the write-back copy operations writing an SSA variable back to its real location”; and “adding, based on said generated list, read-back copy operations at appropriate locations to read values that were potentially modified back into new SSA definitions, the read-back copy operations defining a new SSA variable from a variable’s real location”. While Chow et al. and Radigan both teach the use of SSA representation with the insertion of phi functions, neither Chow et al. nor Radigan discloses any of the foregoing steps. Therefore, it cannot be said that either of these references anticipates claim 1, as amended, and Applicant respectfully requests that the anticipation rejections based on the Chow et al. and Radigan references be withdrawn.

The Information Disclosure Citation Form PTO-1449 returned with the outstanding Office Action contains a notation by the Examiner indicating that Japanese Application Publication Nos. 9-22362 and 10-187463 were not considered because no English Abstracts were included with the submission. Applicant notes that JP Pub. No. 9-22362 and JP Pub. No. 5-19763 claim priority to U.S. Patent Nos. 5,659,754 and 5,293,631, respectively, and

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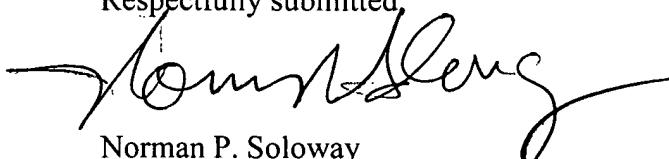
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those priority relationships were disclosed in the IDS filed with the Form PTO-1449, with copies of the U.S. Patents provided at that time. Thus, essentially complete English language versions of JP Pub. No. 9-22362 and JP Pub. No. 5-19763 were provided. In addition, Applicant did in fact provide an English language Abstract of JP Application Publication No. 10-187463 (not JP Pub. No. 5-197563, as erroneously shown on the Form PTO-1449) with the filing of the IDS and Form PTO-1449. Since the only English Abstract provided with a Japanese Application was of JP 10-187463, it is assumed the Examiner actually may have considered JP 10-187463, rather than JP 5-197563, as acknowledged. A copy of JP Pub. No. 10-187463, together with an additional copy of the original Form PTO-1449, are enclosed herewith, and Applicant respectfully requests that the Examiner acknowledge consideration of all previously provided prior art references.

Having dealt with all the objections raised by the Examiner, the Application is believed to be in order for allowance. Early and favorable action are respectfully requested.

In the event there are any fee deficiencies or additional fees are payable, please charge them (or credit any overpayment) to our Deposit Account Number 08-1391.

Respectfully submitted,



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Serial No. 09/837,731
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Annotated Marked-up Figures 1, 4, 5, 8 and 11
Submitted with Amendment A

Figure 1
Modified SSA-conversion process

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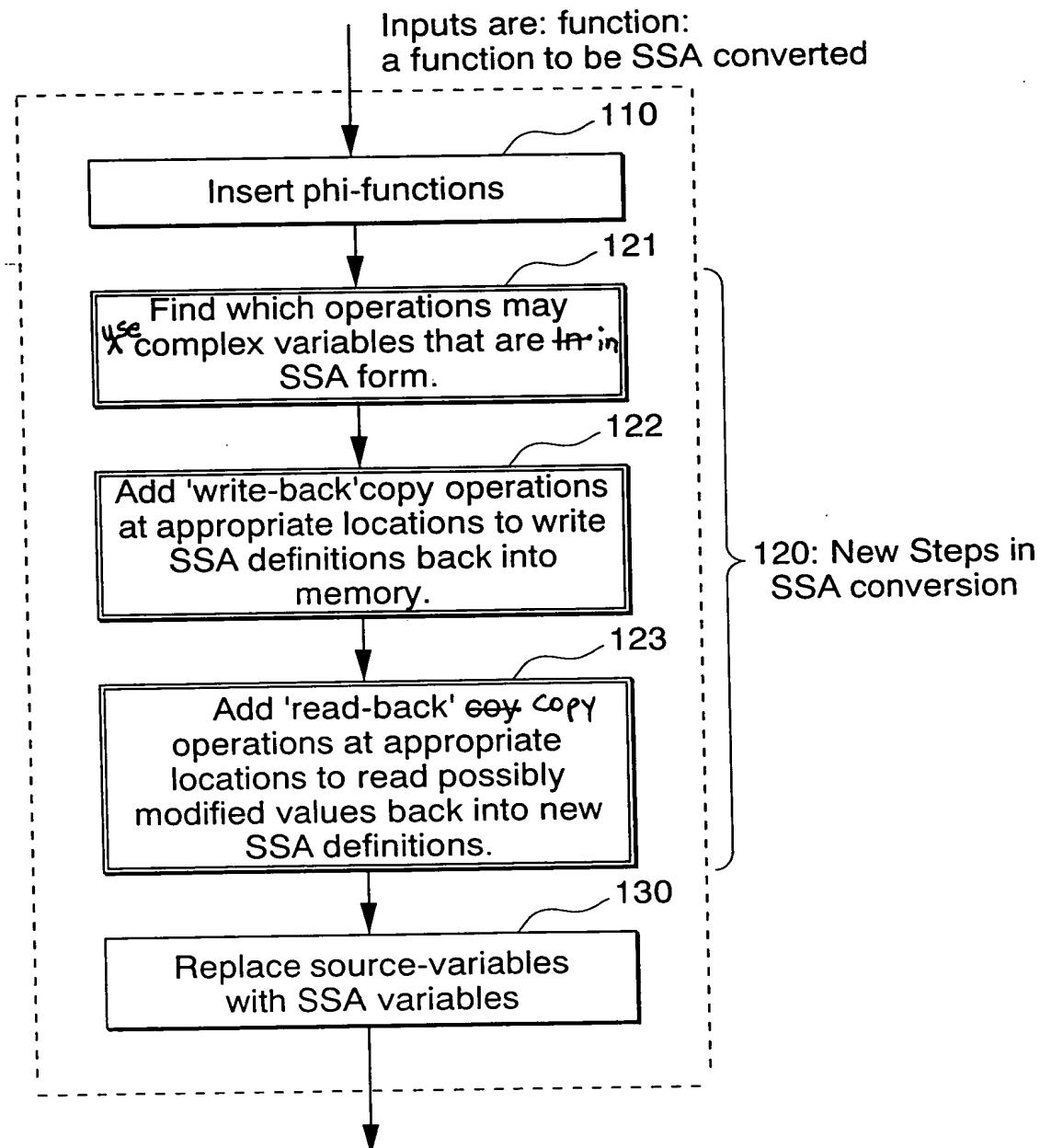
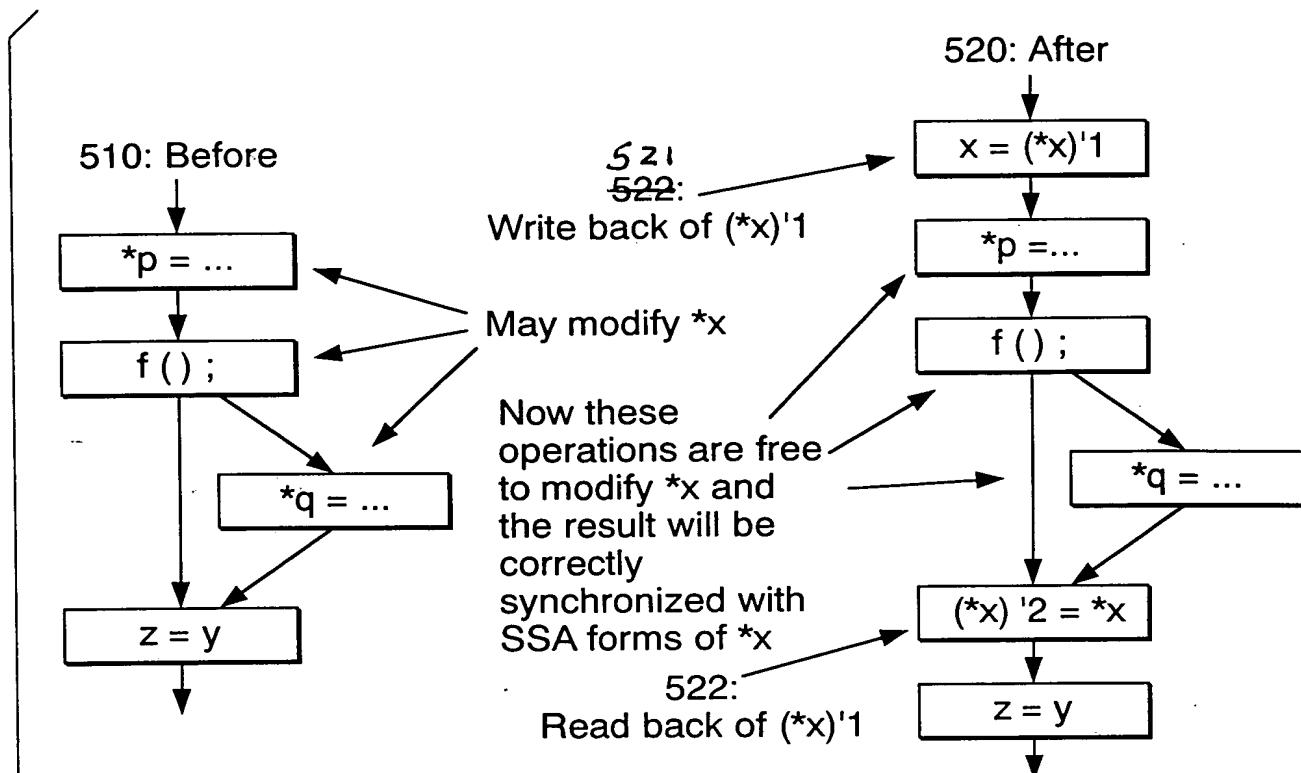


Figure 4

Placement of read/write-backs for the SSA form of $*x$, $(*x)'1$ 

530: A more naive method for synchronization introduces many read/write-backs

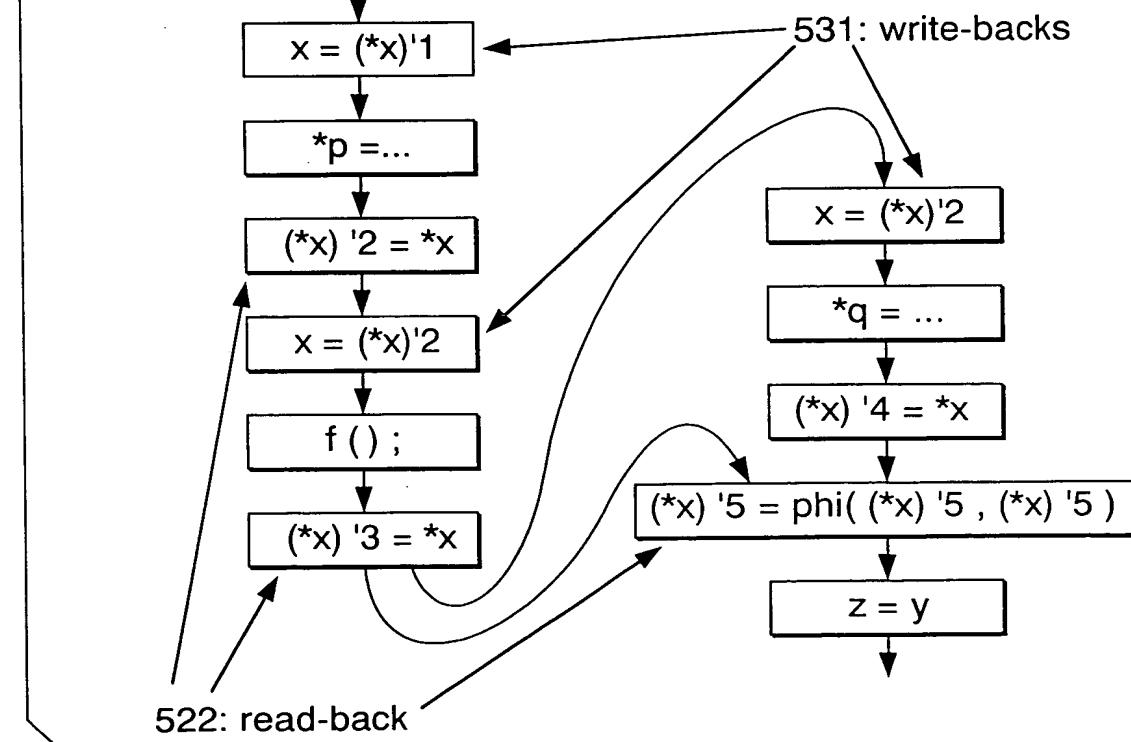




Figure 5

The procedure 'add_syncs_and_write_backs'

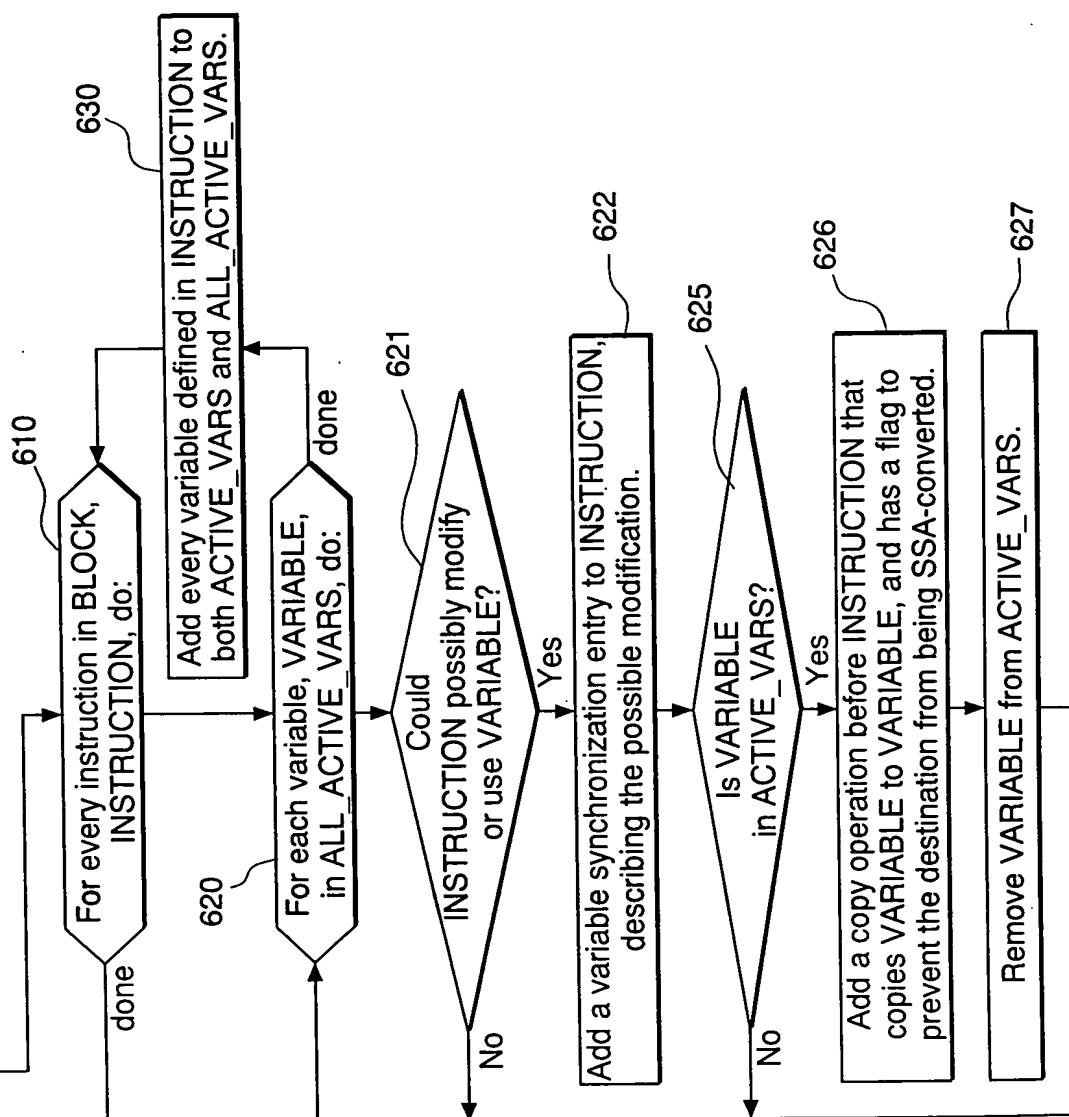
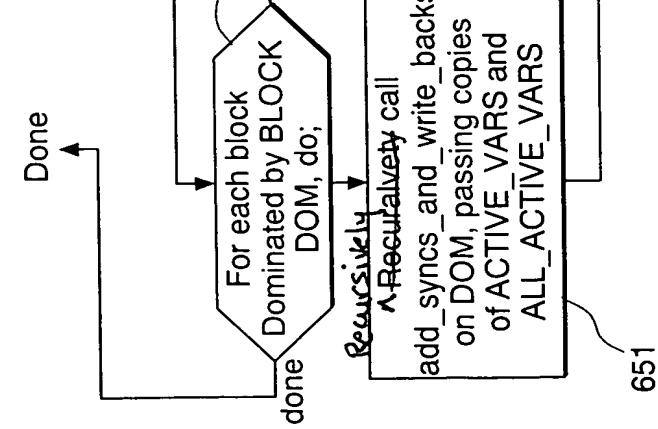




Figure 8

Example source program

This short C program is used to illustrate the invention:

```
extern int g (), h (), i (), x;
int foo (int *p)
{
    (*p)++;
    if (*P > 10)
    {
        g ();
        h ();
        if (x > 5)
            g ();
        if (x > 3)
            i ();
        else
            X = *p;
        *P = 5;
    }
    return *p;
}
```

[810]

Here's the same program converted to a slightly more primitive form:

```
int foo (int *p)
{
    block1:
        *p := *p +1;
        if (*P <= 10)
            goto block8;
    block2:
        g ();
        h ();
        if (x <= 5)
            goto block4;
    block3:
        g ();
    block4:
        if (x > 3)
            goto block6;
    block5 :
        x := *p;
        goto block7;
    block6 :
        i ();
    block7 :
        *p := 5;
    block8:
        return *p;
}
```

[820]

8
[840]

8
[830]



Figure 11 Register-allocated and SSA-unconverted program

using BBA-form requires having a good register allocator that will merge variables where possible, as it tends to generate a lot of variables with short lifetimes. We assume that here.

```
int foo (int *p)
{
    int pv;

    block1:
    pv = *p + 1;
    if (pv <= 10)
        goto block8;

    block2:
    *P = pv;          /* This writes-back pv to *P. */
    g ();
    h ();
    if (x <= 5)
        goto block4;

    block3 :
    g ();

    block4 :
    if (x > 3)
        goto block6;

    block5:
    x= *p;
    goto block7;

    block6:
    i ();

    block7:
    pv =5;

    block8:
    *P= pv          /* This writes-back PV to *P. */

    return pv;
}
```